APPLICATION FOR FEDERAL ASSISTANCE Version 7/03

		2. DATE SUBMITTED: May 10, 2006	Applicant Identifier
1. TYPE OF SUBMISSION: Application ☐ Construction ☑ Non-Construction	Pre-application ☐ Construction ☐ Non-Construction	3. DATE RECEIVED BY STATE	State Application Identifier
		4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

5. APPLICANT INFORMATION

Legal Name: President and Fellows of Harvard College	Organizational Unit: Department: John F. Kennedy School of Government
Organizational DUNS: 08-235-9691	Division: Belfer Center for Science and International Affairs
Address: Street: Office for Sponsored Programs, 1350 Massachusetts Avenue, Suite 600	Name and telephone number of person to be contacted on matters involving this application (give area code) Prefix: Ms. First Name: Rebekah
City: Cambridge	Middle Name
County: Middlesex	Last Name: Coble
State: MA Zip Code: 02138	Suffix:
Country: USA	Email: rebekah_coble@harvard.edu
6. EMPLOYER IDENTIFICATION NUMBER (EIN): 04-2103580	Phone Number (give area code): (617) 496-2504 Fax Number (give area code): (617) 496-2524
8. TYPE OF APPLICATION: ☐ New ☐ Continuation ☑ Revision If Revision, enter appropriate letter(s) in box(es) (See back of form for description of letters.) ☐ ☐ Other (specify)	7. TYPE OF APPLICANT: (See back of form for Application Types) J. Private University Other (specify)
	9. NAME OF FEDERAL AGENCY: U.S. Environmental Protection Agency
10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: 66-034 TITLE (Name of Program): Surveys, Studies, Investigations, [etc.] relating to the Clean Air Act	11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT: Study and Analysis of Policies to Induce Technological Innovation in the Transportation Sector
12. AREAS AFFECTED BY PROJECT (Cities, Counties, States, etc.): China, India, US	
13. PROPOSED PROJECT Start Date: 7/1/2006 Ending Date: 6/30/2009	14. CONGRESSIONAL DISTRICTS OF: a. Applicant Massachusetts 8th b. Project Massachusetts 8th

15. ESTIMATED FUNDING:		16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?
a. Federal	$ 999,658.00	a. Yes. ☐ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON DATE:
b. Applicant	$ 0.00	b. No. ☑ PROGRAM IS NOT COVERED BY E. O. 12372
c. State	$ 0.00	☐ OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW
d. Local	$ 0.00	
e. Other	$ 0.00	
f. Program Income	$ 0.00	17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?
g. TOTAL	$ 999,658.00	☐ Yes If "Yes" attach an explanation. ☑ No

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT. THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.

a. Authorized Representative

Prefix	First Name: Ethlyn	Middle Name: M.E.
Last Name: O'Garro		Suffix
b. Title: Sponsored Programs Officer		c. Telephone Number (give area code): 617-495-5501
d. Signature of Authorized Representative: Ethlyn O'Garro		e. Date Signed: May 10, 2006

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May 10, 2006

Sarah Dunham
Director, Transportation and Climate Division, Office of Transportation and Air Quality
USEPA Headquarters
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: RFA Number EPA-OAR-DOD-05-19

Dear Ms. Dunham:

We are pleased to submit, on behalf of Professor John P. Holdren, a revised proposal entitled "Study and Analysis of Policies to Induce Technological Innovation in the Transportation Sector." The original proposal was sent in response to the above referenced RFA Number on December 9, 2005. Funds in the revised amount of $999,658 are requested for the period July 1, 2006 through June 30, 2009

Please note that the University's qualifications for this project are addressed in Henry Lee's cover letter, signed and dated December 6, 2005.

Your consideration of this proposal is greatly appreciated.

Sincerely,

Ethlyn O'Garro

Ethlyn M.E. O'Garro
Sponsored Programs Officer

Enc.

Study and Analysis of Policies to Induce Technological Innovation in the Transportation Sector

Application Submitted By: President and Fellows of Harvard College

Energy Technology Innovation Project
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RFA Number: EPA-OAR-DOD-05-19
Funding Requested: $ 999,658 over three years

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Project Description

There is a growing belief in both the industrialized and developing world that cleaner and more energy-efficient modes of transportation are needed to meet the challenges of the next century. For the United States, these challenges include urban air pollution, high energy prices, the need for a competitive automobile industry, and the threat of global climate change. Many developing countries share these same concerns. The time has come for policy innovation in this realm. New automotive and fuel technologies now exist that could allow for significant reductions in emissions of conventional air pollutants, toxins, and greenhouse gases. The central problem is not that the technologies do not exist, but rather that these technologies are not being widely deployed in the marketplace due to a combination of barriers and lack of adequate incentives. At this time, most automotive firms now recognize that different policies may provide them with more flexibility and lower costs so the time is ripe for policy innovation in this realm. Using a multi-disciplinary approach, the Energy Technology Innovation Project (ETIP) at Harvard University proposes to undertake a three year effort to explore, identify, and recommend new policy solutions to the dilemmas outlined above through research, analysis, dialogue with stakeholders, conferences and workshops, and the publishing of papers and reports.

Introduction

Impressive gains in reducing criteria air pollutants from motor vehicles in the U.S. have been achieved in recent decades through remarkable innovation in emission control technologies. We define "innovation" as encompassing the processes of research, development, demonstration, early deployment, and commercialization. Yet, despite oil price volatility and increasing concern about the threat of climate change, the overall energy-efficiency (and therefore average greenhouse-gas emissions) of the U.S. passenger car fleet in 2005 is almost exactly the same as it was in 1988. U.S. light-duty vehicles account for 40 percent of the nation's oil consumption and contribute 20 percent of U.S. greenhouse-gas emissions.[1] There also continue to be opportunities for further gains in reducing conventional pollutant emissions as well, especially from diesel-fueled vehicles.

U.S. citizens currently own seven times more motor vehicles on a per capita basis than the world-wide average, but the situation is changing with the rapid industrialization of major developing countries such as China and India. Although China only had 16 million passenger cars on the road in 2004, for example, sales grew 10 to 40 percent annually during the past five years. Motor vehicles are now a leading source of urban air pollution in China where seven of the ten most polluted cities in the world exist, and this problem is likely to become more serious as more vehicles roll out onto the country's already congested roadways.

Many new vehicle and fuel technologies are either close to commercialization or have substantial mid-term promise. Diesel particulate traps and new fuels offer opportunities to further reduce emissions. Efficiency improvements, such as advanced transmission and direct injections, new diesel technologies, and a large range of hybrid technologies are either in the showrooms already, or are close, and would enable

[1] Heavenrich, Robert M., "Light Duty Automotive Technology and Fuel Economy Trends: 1975-2005," U.S. Environmental Protection Agency, Report #EPA420-05-001, June 2005.

automakers to reduce greenhouse-gas emissions. Fuel cells are farther off, but their potential is significant as well.

The availability of new transportation fuels and related technologies is equally impressive. Advanced gasoline blends, biodiesel, compressed natural gas (LNG), liquid petroleum gas (LPG), Fischer-Tropsch diesel fuels, and electric options are now available and used in both commercial and personal vehicles. Cellulosic biomass-based fuels have a potentially enormous resource base and offer significant environmental gains, but they are not in wide use at present.

There are many studies characterizing each of these technical options, and laying out the problems that need to be overcome.[2] Given the near-commercial readiness of these technologies, however, the real challenge for policy makers is how to overcome market and regulatory barriers to stimulate a more rapid development and diffusion of these fuels and technologies in the U.S. and elsewhere.

We plan to identify and rank these barriers during the course of our research, and to determine how these barriers interact with one another to inhibit the development and deployment of advanced technologies. Using the multi-disciplinary expertise of the ETIP group (we have physicists, engineers, international relations specialists, economists, and political scientists within our group alone), we will first identify barriers by type:

- technological/physical (i.e. fuel characteristics)
- engineering (i.e. system integration)
- economic (i.e. cost of fuel and new technologies, cost of impacts on health and environment)
- regulatory/legal (i.e. features of current regulatory systems)
- political (i.e. regional costs and benefits)
- security (i.e. foreign relations)

While some barriers may be immediately obvious, others will require in-depth investigation and research (see months 1-9 in work plan). Once we have identified and classified the barriers, we will rank them within category and overall. Then, we will assess how the barriers interact with one another. Once this process is complete, we will identify the opportunities that exist on their own or from the removal of certain barriers. From this analysis, policy options can be developed.

While there are many policy options, there are three main types of policy strategies that will achieve the desired results: 1) imposing regulations such as emissions trading regimes or performance standards for the production and operation of vehicles and fuels, 2) investing in the development of alternative technologies and fuels and the infrastructure to deliver them, and 3) taxing vehicles or petroleum products. Regulations such as the Tier 2 standards can remove or reduce the market failures that inhibit the diffusion and deployment of these technologies. Federal government

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[2] See, for example, Weiss, M., Heywood, J., Drake, E., Schafer, A., and F. AuYeung, On the Road in 2020: A Lifecycle Analysis of New Automotive Technologies, Energy Laboratory Report #02139-4307, October 2000; World Business Council for Sustainable Development, Sustainable Mobility 2030, 2004; and Portney, P. (Chair), Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards, National Academy Press, 2002.

investments into programs like FreedomCar can create opportunities to reduce costs of new technologies while cultivating new markets. Taxes can stimulate the market for more efficient and cleaner vehicles or create incentives for the use of petroleum product substitutes while putting downward pressure on demand. Within each policy category, of course, there are many options and potential drawbacks. Governments do not need to choose one single strategy or another, but can and should structure a mix of policies with each initiative complementing and reinforcing the other. Finally, it is important to note that options that might be effective and acceptable in the U.S. context might not be as effective in other countries. Therefore we need to develop a menu of options that are tailored to the particular circumstances of a given country, bearing in mind the benefits of technology transfer and the possible advantages of harmonized policies.

Developing effective policies requires a process that consults with, listens to, and incorporates the views of relevant stakeholders. Using our extensive connections in the global auto industry, U.S. organized labor, environmental NGOs, and others, we will solicit the views of stakeholders from the very start. Initially, we will interview key individuals (see months 1-4) and establish a close working relationship with at least one automaker. We foresee hosting one or two major workshops to receive comments on the major policy proposals once they are developed as well.

Engagement with stakeholders is a hallmark of the Kennedy School of Government, which attracts experts from around the globe daily to the School for workshops, conferences, lectures, and executive education programs. Within ETIP, we have convened many individuals in our seminars, conferences, and workshops. Four major workshops we organized recently were:

(1) *Advanced Coal Technologies in a Sustainable Energy System: Preparing and Preserving Appropriate Technological Options*, September 2005. Participants included representatives from the China Ministry of Science & Technology, Huaneng Power Corporation, BP, U.S. Electric Power Research Institute, China Thermal Power Research Institute.

(2) *Sustainability and Risk: Climate Change and Fiduciary Duty for the Twenty-First Century Trustee*, workshop held on September 23, 2004 at Harvard University. Participants included representatives from Lehman Brothers, Cinergy, Swiss Re, and the State Treasurers from Connecticut and Maine.

(3) *Energy Technology Research and Development in India and the United States: Opportunities for Collaboration*, workshop held in New Delhi, India on August 19-21, 2004. Participants included representatives from the Indian Oil Corporation Ltd., Ministry of Petroleum and Natural Gas, Tata Motors, and the Society of Indian Automobile Manufacturers (SIAM).

(4) *Workshop on IGCC Development: Financing and Deploying IGCC Technology in this Decade*, Feb. 11, 2004 at Harvard. Participants included representatives from Eastman Chemical, Princeton University, MIT, Center for Clean Air Policy, Natural Resources Defense Council, and the Public Utility Commission of Ohio.

Work Plans

In the first year, our work will focus on developing strategies, policies, and implementing proposals that can be adopted by the United States. It is our plan to expand the work in years 2 and 3 to explore these same issues, but from an international perspective.

During the course of this research, interviews with stakeholders will be frequent so that we understand their needs, goals, and elicit all creative policy ideas. Through our research, we intend to develop credible estimates of costs of – and an understanding of -- the barriers to the introduction of new technologies, and credible costs of and barriers to various possible policy measures intended to smooth their introduction.

We plan to overcome the barriers to the deployment of cleaner vehicle technologies by working closely with industry, NGOs, and government to define the barriers to technical and regulatory changes, and to define practical means for either dismantling or overcoming them. Our proven ability to convene stakeholders and work with them in an atmosphere that deserves and establishes trust among all participants will be the key to making this approach work.

U.S. Domestic Work Plan

Year 1

Months 1-4:

We will begin with a technical assessment, literature review, and mapping of the "landscape" of U.S. and other international policies related to cleaner and more efficient vehicles.

We will also conduct initial interviews and/or meetings and workshops with the stakeholders, including one or two major automakers, auto parts suppliers, organized labor (United Auto Workers, AFL-CIO), oil companies, biofuels producers, consumers groups, and policymakers from different countries. To initially gain access to the stakeholders, we will use the connections we have cultivated through past engagement with these companies and organizations. To provide a few examples, John Holdren and Kelly Gallagher interacted frequently with top representatives from the AFL-CIO, United Auto Workers, ConocoPhillips, Consumers Union, and others as part of the National Commission on Energy Policy. We have a new project working with Princeton University and BP on climate change policy. Ford and GM are both sponsoring research in China that is being done by ETIP in collaboration with the China Automotive Technology & Research Center. William Rosenberg interacted frequently with the auto industry when he negotiated and implemented the 1990 Clean Air Act Amendments. Bob Frosch worked at General Motors as Vice President in charge of research and still has many contacts in the industry.

We will do a preliminary ranking of barriers based on the literature review and interviews with stakeholders. At this point we will also preliminarily identify possible policy strategies. Once we determine which strategies seem to have the most potential for achieving the ultimate goals, we will establish working assumptions about the optimal levels of pollution control and the appropriate timing for policy implementation. We will seek comments on these levels and, rather than use them as absolute goals, they will serve as guides to identify further research needs.

In the first months, we will also initiate a new monthly seminar series on *Technological Innovation in the Transportation Sector.* This seminar will be open to the public, and will be advertised on our website (http://www.bcsia.ksg.harvard.edu/energy). We will use the seminar series to regularly convene all of the experts at Harvard and nearby universities who will be involved in our project. Results from ongoing research projects will be presented in the seminars for critique. The seminars will also offer opportunities for stakeholders to present their views. We will use the model of our existing ETIP seminar series for this special seminar series in that we ask speakers to present ongoing research so as to benefit from comments before the work is complete. We also use the seminars to guide graduate students and pre- and post-doctoral fellows by directly offering suggestions and also exposing them to the efforts of top-notch faculty researchers so they can learn through observation and interaction.

Months 5-14:

This is the major research stage in the first year, where we either do research papers within the Energy Technology Innovation Project or commission other faculty members and experts as needed. Possible areas of deeper research to better understand the key barriers and incentives include:

- Assessing the technical potential and economic implications of the use of alternative fuels to affect criteria pollutant and GHG emissions from automobiles.
- Analyzing the industry and consumer costs and benefits of different policies and strategies, including the economic costs of the transitioning to the production of different vehicle and fuel technologies. This will be done by examining the auto sector in detail as well as the economy as a whole by using macroeconomic models.
- Assessing which U.S. policies promote technology transfer to developing countries most effectively in the realm of vehicle technologies and fuels.
- Examining the effect of changes in fuel prices on producers and consumers.
- Investigating how new policies for the transportation sector might affect consumer demand. For example, what is the role of government in stimulating consumer demand for lower polluting and more energy-efficient products? What policy tools might be useful in stimulating consumer demand, and which tools (i.e. consumer tax credits or government-funded education programs) have worked in the past in the U.S. and elsewhere?
- Assessing how to manage the costs of new policies to motor vehicle manufacturers. For example, what are the pros and cons of manufacturer tax credits? Could costs be passed on to consumers? If not, could some of those costs be absorbed by the government? What effect will different policies have on model mix?
- If emissions trading emerged as one of the attractive policy options, the design of an emissions trading regime for the transportation sector would require careful consideration. How could the allocation of allowances be managed? What are the implications of using historical emissions as a metric? What are the benefits to domestic versus foreign automakers? What kinds of market shifts might occur upon the creation of an emissions trading regime? Should allocations change if the market changes? What are the merits and disadvantages of including a "safety valve" in the design of the regime to manage economic costs?

At the end of this first research stage, we will stop to synthesize the results. We will convene an internal workshop with all the researchers to determine which barriers seem to be the most significant to hindering the ability of advanced vehicle technologies and fuels to penetrate the marketplace. We will also do a preliminary assessment of the potential opportunities for removing and/or overcoming these barriers.

Months 14-18:

As the research papers are produced, we will devise an initial set of promising policy options and produce a draft concept paper which will offer one to three alternative policy proposals for managing emissions, accelerating the deployment and use of

alternative fuels, and improving fuel efficiency from automobiles. The paper will not be published but instead will be circulated to interviewees and stakeholders for comment. It will then be revised and posted on the ETIP website.

Months 18-27:

In the middle of the second year, we will write and publish a working paper articulating a single policy proposal, taking into account comments received. It will be reproduced in hard copy and posted on the ETIP website. The working paper will be circulated widely to academic experts, government officials, industry, non-governmental organizations, consumer groups, experts at think tanks, and labor groups.

An invitation will be issued to selected representatives from these various constituencies to participate in a roundtable discussion at Harvard on the proposal contained in the working paper. Individual meetings and smaller workshops will be organized with different stakeholders to solicit comment as well. It is our expectation that these workshops will identify new ideas that will need to be researched, as well as force us to delve deeper into previously researched topics. Much of the research will be done in the period between the workshops. Thus, the process would be iterative. Workshops will inform the research, and the research will inform the workshops. In addition, we will hold smaller meetings with experts and stakeholder groups to discuss particular issues and to obtain additional data, information, and insights.

During this period, additional research papers will be produced as stakeholders and reviewers identify issues that need to be explored in greater depth.

Months 27-36:

Once we have received sufficient comment and feedback from stakeholders, we will produce a draft final report that will be accompanied by an appendix containing the papers commissioned as part of this effort, and the rapporteurs' reports from our workshops.

(For further detail on final grant year, see "Combined Work Plan" below, after "International Work Plan")

International Work Plan

Months 13-30:

ETIP has built an extensive program of research and policy-outreach in China and India using a collaborative approach that involves working closely with partners in those countries. In China, ETIP has formal partnerships with the Ministry of Science and Technology (MOST), Tsinghua University's School of Public Policy and Management, the China Automotive Technology & Research Center (CATARC), and the China Coal

Research Institute (CCRI). In India, we have partnerships with The Energy Research Institute (TERI) and the Indian Institute of Management of Ahemdabad. In addition, ETIP has many contacts in Brazil and Mexico.

Utilizing these existing partnerships, ETIP will work with colleagues in China and India to develop policy proposals for developing and deploying cleaner and more efficient vehicle and fuel technologies in those countries, with particular emphasis on promoting both technology transfer from the U.S. and the cultivation of capabilities for cleaner and more energy-efficient technologies within each country.

In China, we have a number of initiatives already underway that we will pursue as described below. The China work will build on research already completed by ETIP Director Kelly Gallagher and the numerous Chinese research fellows and visiting scholars who have worked within ETIP. A major book by Gallagher entitled *China Shifts Gears: Automakers, Oil, Pollution, and Development* will be published by MIT Press in 2006. This book is about technology transfer from the U.S. auto industry to China, and it explores the incentives and disincentives for cleaner technology transfer based on the three cases of the U.S.-Chinese joint venture firms Beijing Jeep, Shanghai GM, and Chang'an Ford. The conclusions of this book about technology transfer will serve as working hypotheses for our future study. The main conclusions were that the lack of regulations and policies in China created a situation where there were few compelling incentives for the U.S. firms to transfer more advanced technologies to their Chinese partners. In addition, the Chinese firms failed to bargain for cleaner technologies in their joint venture agreements for a variety of reasons, and the U.S. firms never transferred technologies beyond what was required by Chinese regulations. The ongoing and new initiatives we wish to pursue are as follows:

- Taking the next step in our recent research on technology transfer from the U.S. to China in the automotive sector, we plan to look specifically at the question of the barriers and incentives related to the production of hybrid-electric vehicles in China because of their inherently low conventional criteria pollutant and greenhouse-gas emissions. Hybrid cars are currently not sold in China despite announcements by major automakers that they intend to produce them there. Chinese-made hybrid buses are not doing particularly well in the current demonstration projects, but it is not known why. As a next step, we plan to hold a manufacturers' roundtable discussion in the spring of 2006 in China on the barriers to the production of hybrid-electric vehicles in China. This initial workshop will serve as the springboard for more research in this area. The roundtable is already partially funded through the China Sustainable Energy Program of the U.S.-based Energy Foundation.
- We also plan to continue to work on the development of policies that spur the propagation of cleaner fuels because we have identified as one of the key barriers to the use of more advanced pollution-control and energy-efficiency technologies in motor vehicles the high sulfur levels in Chinese fuels.
- We will also continue working with CATARC and Tsinghua University to determine the factors that lead to high emissions of conventional pollutants from Chinese vehicles that are already on the road.

We have a different set of plans for our work in India, building on a recent workshop held in 2004 entitled "Energy Technology Research and Development in India

and The U.S.: Opportunities for Collaboration." ETIP and The Energy and Resources Institute (TERI) jointly organized this workshop, held in New Delhi, India under the auspices of the U.S.-India National Academies' joint study on energy and environmental cooperation between the two countries (chaired by Prof. John Holdren) and the Indo-U.S. Science & Technology Forum. The workshop brought together a number of senior Indian and U.S. experts and identified joint opportunities and avenues of cooperation between India and the U.S. to strengthen their energy-innovation activities. The two-day workshop focused on the following areas: Vehicles, Hydrocarbon Fuels, Energy Efficiency, Power Generation, Biomass, (non-Biomass) Renewable Energy, and Hydrogen Technologies. As a next step, ETIP is engaging in conversations with the Indo-U.S. Science & Technology Forum to explore the possibility of setting up an Indo-U.S. Joint Energy Innovation Center to facilitate and catalyze, on a sustained basis, joint activities between Indian and U.S. institutions on various aspects of energy innovation, including for the transportation sector.

Based on all of our work up to this time in both countries, we plan to conduct a comparative analysis of technological change in both the Indian and Chinese automobile sectors. We will identify the key barriers to the transfer of cleaner technologies and fuels in both countries, and see which barriers hold true in both China and India. We will also identify options for accelerating the transfer of cleaner technologies from the United States to China and India.

Combined Work Plan

Months 30-36

We will review the comments we receive back from EPA on both the international and domestic policy proposals. Where needed, we will conduct additional research and make the necessary changes in the draft and submit a final document, along with the additional papers produced as part of the project and copies of all the workshop rapporteurs' reports.

This final report will contain a complete policy proposal along with a detailed plan for assuring early and aggressive deployment of advanced vehicle technologies and low-polluting fuels in the United States. Recommendations for how to spur technology transfer from the United States to China and India will also be included, based on the research and projects outlined below in the International Work Plan. We will also publish our findings in peer-reviewed journal articles. We will also identify further research needs that need to be met outside the scope of the cooperative agreement.

Finally, and perhaps most importantly, we will circulate our reports widely through web postings, mailings, briefings for stakeholders and policy makers, and at relevant conferences. This process of educating others about the concepts contained in the policy proposal, and their advantages and disadvantages, is essential. In our recent experience through the National Commission on Energy Policy, the IGCC financing proposals, and in China and India, if one does not personally brief decision makers in both government and industry about the details of the recommendations, they are not likely to be understood nor adopted.

Project Management

John Holdren and Henry Lee will be the co-principal investigators of this initiative. In this capacity they will have overall responsibility for the project. William Rosenberg will direct the stakeholder participation efforts, identifying key participants, structuring the workshops and, where appropriate, initializing additional discussions with key officials from industry, government, and interest groups. Kelly Sims Gallagher will direct the research efforts, including designing and implementing a research agenda, commissioning papers, convening seminars, and recruiting and working with a team of experts from Harvard, other universities, and leading research institutions. CV's of these principals are attached in the Appendix.[3]

In addition, we plan to link the project with the Harvard University Center on the Environment, which will attract faculty from the Economics Department, as well as from the Division of Engineering and Applied Sciences (DEAS), the Law School, and Business School. To facilitate this interaction, we will establish a monthly seminar. Among the faculty that we may involve are economists Robert Stavins and Ariel Pakes, technology innovation experts Robert Frosch and Professor Robert Austen (formerly held senior roles with General Motors and Ford Motor Company, respectively; Frosch is also an ETIP Senior Research Associate), and corporate strategists Professor Malcolm Salter and Professor H. Kent Bowen. Bowen, Austen, and Frosch have advanced degrees in engineering and are among the nation's leaders in their fields. In addition, we plan to invite Professor Roger Porter, former chief policy assistant to President George H.W. Bush, Professor Dale Jorgensen, a world expert on macro-economic growth and technology innovation, and Professor William Hogan, a leading expert in fuel policy. ETIP Research Associate Ambuj Sagar (who is also Assistant Dean of Engineering at Harvard), will be our lead for the India effort. Post-doctoral Research Fellow Hongyan He Oliver will assist Kelly Gallagher in the China effort. Finally, outside Harvard University, we may invite Professor John Heywood (MIT Automotive Lab), Dr. Frank Ackerman (Tufts University), and Phil Sharp (President, Resources for the Future) to participate.

Finally, we will form a small advisory board, chaired by William Rosenberg, which will include the principals from Harvard, a senior official from the automotive industry, a major environmental NGO, and the federal government. The purpose of the board will be to develop a strategy for obtaining effective stakeholder involvement and to write the schedule and agenda for the workshops.

[3] We have arbitrarily chosen to omit Henry Lee's C.V. from the Appendix, as we are limited to three. See his short bio below.

Anticipated Outcomes and Linkage to EPA's Strategic Plan

Outcomes and Outputs

As articulated in the work plans, the ultimate target for this research project is the development of a detailed policy strategy for inducing early and wide-spread deployment of low-emission vehicles and fuels into the marketplace. We will develop policy strategies for the United States, China, and India (including how these countries can cooperate on policy goals). Numerous products besides these ultimate policy proposals will also be important outputs. These include individual research papers on important sub-topics that will inform the ultimate policy plan, the engagement of stakeholders though interviews and workshops/conferences, the creation of a monthly public research seminar, the training and mentoring of talented students and research fellows, and the "marketing" of the policy proposals through briefings of stakeholders and government officials.

Linkages to EPA's Strategic Plan

Because the outcomes of this project should result in significantly reduced emissions of criteria pollutants, toxics, and greenhouse gases from mobile sources, this project strongly supports the goals set forth in EPA's Strategic Plan, particularly with respect to Goal 1 on Cleaner Air and Global Climate Change.

Benefits to the Public

The products of the proposed effort are multifold. First, we will produce detailed policy proposals containing strategies for aggressive deployment of low-emission vehicles and fuels for the U.S., China, and India. At a minimum, these reports will significantly improve the federal government's understanding of the barriers to accelerated market penetration of these technologies and fuels. By involving stakeholders in the development of new strategies and polices, we believe there is also a good possibility that a constituency will evolve for their adoption.

As economic growth in the developing world proceeds at a rapid rate, the number of new vehicles bought, the number of vehicle-miles driven, and the amount of pollution emitted will increase at unprecedented rates. The spillovers in the form of more acid rain, mercury pollution, particulate emissions, and increased greenhouse gases will be significant. As recent studies have suggested, pollution from one country can travel thousand of miles beyond its borders. It is not enough to develop and deploy policies to span the development and penetration of new vehicles and fuels in the United States. We must also work with countries like China and India to develop new initiatives to transfer cleaner and more energy-efficient technologies to these countries. We believe that this project will provide U.S. decision makers – both public and private – with a better understanding of the barriers to introducing advanced motor vehicle technologies in the developing world and how these barriers might be reduced.

We will also contribute to the advancement of knowledge by publishing our key findings in the peer-reviewed literature. We expect that some of the discrete research papers assigned during months 1-4, and researched and written during the course of the project, will be suitable for publishing in journals such as *Transport Policy, Energy*

Policy, Issues in Science and Technology, and the *Journal of Environment and Development.* In the end, the papers may fit together well into an edited book, although this cannot be guaranteed at the outset. Working papers, workshop presentations, talks, and lectures will all be made available on the ETIP website, with authors' permission.

Another important contribution of this project is that we will be creating career development opportunities for outstanding students, pre- and post-doctoral research fellows, and faculty members and research partners in other countries. ETIP is proud to have developed a thriving program that attracts some of the best young researchers and visiting scholars from around the world. By bringing them together to do research with us at Harvard, not only do they benefit directly from our seminars, research training, and classes, but they also benefit from educating each other based on their rich experience and varied backgrounds. This specific project will allow ETIP to bring together a new set of faculty, research fellows, and graduate students to work together on addressing these important national and international challenges. We expect that the individuals who participate in this project will go on to directly work in government or to continue to do policy research in other university settings, thereby propagating the wider policy community with talented and well-trained professionals.

How Will Project Outcomes Be Designed For Reinvestment?

Many reports have been written on technical options for improving motor vehicle energy efficiency, reducing air pollution, and developing new fuels that might serve as substitutes for petroleum. The unique aspect of this proposal is the stakeholder involvement process and our effort to involve a much larger cross-section of relevant disciplines.

There are two possible outcomes, and both will stimulate action. In the first scenario, we will develop one or more proposals that will facilitate a paradigm shift in the positions that key stakeholders have held. There is no guarantee that this will occur, but by integrating the policy research with stakeholder participation, we believe we will improve the possibilities.

In the second scenario, our strategies and policy recommendations do not result in an immediate shift in positions and policies, but will significantly enhance the understanding of the barriers and opportunities. Improved understanding will lead to more debate, more analysis, and gradually to the required paradigm shifts that lead to aggressive deployment of low-emission vehicle technologies and low-emission fuels.

How Will Project Success Be Measured?

Fostering a better understanding of the barriers to the deployment of new technologies and the options and the opportunities for reducing or eliminating those barriers is difficult to measure, and indeed good metrics for technological innovation are hard to find because of data availability and other problems as documented in a recent article by ETIP's Sagar and Holdren in *Energy Policy.*[4] One can measure success by looking at the quality and quantity of the analyses, the number of new ideas and policy

[4] Sagar, Ambuj and John P. Holdren. "Assessing the Global Energy Innovation System: Some Key Issues." *Energy Policy* 30, no. 6 (2002): 465-469.

alternatives developed, the extent of stakeholder exposure and support, the number of new researchers studying the policy, logistical, and economic issues often ignored by literature that is overly weighted toward engineering barriers. Indeed, we will keep track of these metrics because we do intend to conduct high quality research, deeply engage with a wide range of stakeholders, and attract top-notch experts and researchers from a variety of academic disciplines to work with us.

To an extent, true success involves changing paradigms and developing a new consensus, but this rarely occurs simultaneously with the publication of a report or the articulation of ideas and options at a workshop. Instead, shifting policies and programmatic initiatives is a slow, intensive process. The seeds are planted with new and creative ideas, rigorous analysis, and careful study. They are nurtured by dialogue, discussion, and debate among experts and stakeholders. They are eventually harvested by policy makers. These efforts may be iterative, not parallel. They can take one year or an entire decade.

This project will surely plant the seeds and initiate the dialogue, discussion, and debate. It is along these lines that the project must be evaluated.

Programmatic Capability

Organizational Experience: The Energy Technology Innovation Project (ETIP)

The overarching goal of ETIP is to identify and then seek to promote adoption of effective strategies for developing and deploying cleaner and more efficient energy technologies in three countries: China, India, and the United States. These are, by most measures, the largest energy-consuming nations in the world and as such have enormous influence on local, regional, and global environmental conditions.

ETIP researchers seek to identify and promote strategies that these countries can pursue, separately and collaboratively, for accelerating the development and deployment of advanced energy options that can reduce conventional air pollution, minimize future greenhouse gas emissions, reduce dependence on oil, facilitate poverty alleviation, and promote economic development. ETIP focuses on three crucial countries, rather than only one, in order to increase its ability to analyze and formulate policy and leverage on national and international policy outcomes. Its cross-national approach facilitates the pursuit of cooperative policy initiatives and allows for the development of new insights from comparisons and contrasts among conditions and strategies in the three cases.

ETIP is a joint project of the Science, Technology, and Public Policy Program and the Environment and Natural Resources Program of the Belfer Center for Science & International Affairs (BCSIA) of the John F. Kennedy School of Government at Harvard University.

Characteristics of ETIP that define its niche in research, training, and policy engagement in the energy and climate-change realm include:

- Academic excellence in policy research and analysis
- Unusual policy "entrepreneurship" capabilities and connections
- Exceptional convening power due to the project's location, at Harvard University, in the leading graduate school of public policy in the world
- Extraordinary opportunities to mentor and train top young energy professionals, especially those from developing countries, by virtue of the attractions of Harvard and the Kennedy School for the very best people.

ETIP is comprised of Kennedy School of Government faculty, young pre- and post-doctoral researchers, senior research associates, visiting scholars, research affiliates, and graduate students. We are one of only a few prominent academic research centers -- nationally and internationally -- for scholars who wish to conduct interdisciplinary, policy-relevant research on energy topics.

ETIP attracts some of the best thinkers in the field from around the world, and provides a forum for students, doctoral and post-doctoral fellows, and senior academic experts to work together on some of the most challenging energy issues facing the world. It is a central mission of ETIP to support and guide the best young researchers in the energy policy field from the three countries that we study. In weekly seminar series and other interactions, the research fellows present ongoing research efforts and receive comments and recommendations from the other fellows, faculty, and senior staff. This

rigorous peer review prepares the fellows for publishing and presenting their research results in policy and academic settings. In addition, fellows are exposed to (and contribute to the development of) useful methodologies for conducting interdisciplinary assessment in the energy field.

ETIP is the only major academic energy research group that is embedded in a leading school of government, with all of the policy strengths and access to policy makers that this implies. Most of the members of the project have prior experience in government, NGOs, and industry—much if it at very high levels—and thus are highly effective in translating research findings into policy recommendations.

Staff Expertise, Qualifications, and Knowledge

Complete Curriculum Vitas for John Holdren, Kelly Sims Gallagher, and William Rosenberg are included in the Appendix. We have arbitrarily chosen to omit Henry Lee's C.V., because we are limited to three. Prof. Lee's leadership and expertise are nonetheless critical to the project, and we have provided more detail for him than for others in the following professional highlights of the four principal researchers involved in the project:

Henry Lee

Henry Lee is the Jaidah Family Director of the Environment and Natural Resources Program within the Belfer Center for Science and International Affairs (BCSIA) at Harvard's John F. Kennedy School of Government, Faculty Co-Chair of the School's International Infrastructure Program, and a Lecturer in Public Policy. In addition, he co-teaches the KSG course on energy systems and is one of the core faculty members in the school's executive training program for China's development leaders. Mr. Lee is on the board of BCSIA and the Middle East Initiative at the School.

Before joining the Kennedy School in 1979, Mr. Lee spent nine years in Massachusetts state government as Director of the State's Energy Office and Special Assistant to the Governor for environmental policy. Prof. Lee has served on numerous state, federal, and private advisory committees on both energy and environmental issues, worked with private and public organizations (including the U.S. Departments of Energy and the Interior, U.S. EPA, the National Park Service, the Pew Charitable Trusts, the Brazilian National Development Bank, the Inter-American Development Bank), and has served on several corporate boards. His research interests have focused on electricity and water privatization, environmental management, global climate change, and the political economy of energy. Mr. Lee is the editor of "Shaping Responses to Climate Change," the report of the Harvard Global Environment Policy Program, and is the author of recent reports on Electricity Restructuring and the Environment, LNG, and Distributive Electricity Generation.

Kelly Sims Gallagher, Director, Energy Technology Innovation Project

- Expertise in energy and environmental policy, with emphasis on transportation, technological change, and the automobile industry
- Author of forthcoming book entitled *China Shifts Gears: Automakers, Oil, Pollution, and Development* (MIT Press)
- Participant in more than a dozen rounds of international climate change negotiations
- Proficient in Chinese

John P. Holdren, Teresa and John Heinz Professor of Environmental Policy and Director of Program on Science, Technology, and Public Policy

- Expertise in energy, environment, and arms control policy
- Co-Chair of the National Commission on Energy Policy
- Member of the National Academies of Science and Engineering
- Chair of Study on Federal Energy Research and Development for the Challenges of the 21st Century, 1997, for President's Committee of Advisors in Science & Technology (PCAST)

William Rosenberg, Senior Research Fellow, Energy Technology Innovation Project

- Former EPA Assistant Administrator for Air and Radiation
- Negotiated and implemented 1990 Clean Air Act Amendments
- Helped establish the Acid Rain Allowance Trading System, CFC phase out program, reformulated gasoline (including ethanol additives), and Tier I emission standards for cleaner cars

Following are professional highlights for additional ETIP fellows and associates who will contribute extensively to the project, but who will not be compensated through the project's budget:

Robert Frosch, Senior Research Associate, Science, Technology, and Public Policy Program

- Former Vice President of General Motors in charge of Research Laboratories
- Former Administrator of NASA
- Member of the National Academy of Engineering
- Former Assistant Executive Director of the UN Environment Programme

Hongyan He Oliver, Research Fellow, Energy Technology Innovation Project

- Ph.D. in Civil and Environmental Engineering, Stanford University
- Expert on implementation and enforcement of environmental regulations in China
- Manager of ETIP project estimating emissions from in-use vehicles in China
- Fluent in Chinese

Ambuj Sagar, Assistant Dean for Strategic Planning, Division of Engineering and Applied Sciences, Harvard University and Senior Research Associate, Energy Technology Innovation Project

- Ph.D. and an M.S. in Materials Science, as well as an M.S. in Technology and Policy, from the Massachusetts Institute of Technology
- Expert on energy-technology innovation
- Expert on technological change in the Indian automobile industry
- Fluent in Hindi

Experience in Government and Industry

William Rosenberg has extensive experience in shaping U.S. efforts to reduce pollution from mobile sources. As the U.S. Environmental Protection Agency's Assistant Administrator for Air in the early 1990s, he managed the development of the reformulated gasoline program, working closely with both the nation's automobile and energy industries. While at the Kennedy School, Rosenberg has spearheaded the development of innovative financing schemes to stimulate the deployment of gasification technologies in the U.S. In this capacity, he and others at the Kennedy School worked closely with key stakeholders, including the coal and natural gas industries, investment houses, environmental NGOs, and federal and state officials. Many of his ideas on how to spur the deployment of gasification technologies were adopted in the 2005 National Energy Policy Act legislation.

John Holdren, as a member of President Clinton's Committee of Advisors on Science and Technology (PCAST), chaired an extensive review of U.S. research and development policies affecting alternative fuels, including hydrogen, ethanol derived from cellulose materials, compressed natural gas, and biodiesel alternatives. In addition, he has worked extensively on designing and managing joint efforts between the U.S. and China, India, and other developing countries.

Henry Lee recently completed studies on LNG policy, air emissions in the Midwest, and decentralized energy alternatives, and has co-chaired the Kennedy School's program on infrastructure in developing countries. The program trains senior leaders from China, Nigeria, Pakistan, and Brazil. In addition, it hosts an annual program for energy and transport specialists that has drawn participants from 40 countries.

Robert Frosch served as Vice President in charge of Research Laboratories at General Motors for approximately a decade. He is a member of the U.S. National Academy of Engineering, and held many distinguished positions in the federal government, as noted above.

Kelly Sims Gallagher worked in strategic planning at Fluor Daniel Environmental Services, served as a Truman Scholar in the Office of the Vice President in The White House, and worked as Science Policy Director at the environmental group, Ozone Action.

Past Experience and Performance in Successfully Completing Similar Projects

National Commission on Energy Policy

ETIP Faculty Director and principal investigator Dr. John Holdren was Co-Chair of the National Commission on Energy Policy, a bipartisan panel of 18 members funded by a consortium of U.S. foundations. ETIP Director Kelly Gallagher served as Holdren's deputy in his capacity as Co-Chair. The goal of this Commission was "to develop a long-term U.S. energy strategy that promotes national security, economic prosperity, and environmental safety and health." The other two chairs were John Rowe, CEO of Exelon, and William Reilly, former Administrator of the U.S. Environmental Protection Agency. The Commission released its blueprint for a U.S. national energy strategy in December 2004. (See www.energycommission.org for the full report.) ETIP researchers performed a number of background studies for the report. The three sections to which ETIP contributed most heavily were the ones on climate change, transportation, and technology policy.

Energy-Technology Innovation

ETIP continues to be one of the few organizations in the U.S. to study the phenomenon of energy-technology innovation (research, development, demonstration, and deployment). Insights from ETIP's work were adopted by the National Commission on Energy Policy. Members of ETIP wrote three background papers for the Commission.

In addition, ETIP regularly updates and expands its database on U.S. government investments in energy-technology innovation. This database tracks U.S. government spending on energy research, development, and deployment since 1979 and includes not only the raw data, but also a number of illuminating charts, several of which were included in the National Commission on Energy Policy's report. The database is available on the ETIP website: http://www.bcsia.ksg.harvard.edu/energy.

The U.S. Government Role in Energy Technology Innovation and Public-Private Partnerships

Former ETIP Director Dr. Vicki Norberg-Bohm led a research project on the role of government in technology innovation, supported largely by the U.S. Department of Energy. This effort sought to better understand how and under what conditions public policy can effectively and efficiently support and stimulate private sector investments in the development and adoption of environmentally-enhancing radical technological innovations. In addition, Dr. Norberg-Bohm led a project that focused on evaluating the effectiveness of voluntary, collaborative, and information-based approaches. A book manuscript co-authored by Vicki Norberg-Bohm and Theo de Bruijn entitled *Sharing Responsibility for Industrial Transformation: Environmental Policy Innovation in the United States and Europe*, which built on a major workshop was published by MIT Press in 2005. Former ETIP research fellows Chad White and Rutu Dave also contributed to this work in their evaluations of two of the U.S. Department of Energy (DOE) public-private partnership programs: Building America and Clean Cities.

History of Meeting Reporting Requirements and Submitting Final Technical Reports

The Energy Technology Innovation Project at the Kennedy School of Government has a ten-year record, and it currently maintains an annual budget of approximately $1 million of grant-sponsored research. We are currently receiving funding from The Energy Foundation, Heinz Family Foundation, William & Flora Hewlett Foundation, David & Lucile Packard Foundation, Winslow Foundation, GM China, and Ford China. All of these funders have strict reporting requirements that we have adhered to in the past and continue to meet on an ongoing basis. Our publication record demonstrates that we have a long record of submitting final technical reports and related papers, as well as publishing in the peer-reviewed literature, in accordance with our grant requirements. For a bibliography of publications and reports, please visit our website at http:/bcsia.ksg.harvard.edu/energy. Then click on "Publications" on the left navigation bar nearer to the center of the page.

The project listed in the previous section on the U.S. Government Role in Energy Technology Innovation, sponsored by the U.S. Department of Energy, is one example of a substantial federally-funded research project that was completed in full compliance with all requirements. This project resulted in two technical reports that were submitted to DOE, as well as a workshop report and the book mentioned above that was published by MIT Press this year.

Established Record of Involving Faculty and Students in Collaborative Study Projects

The Energy Technology Innovation Project has conducted collaborative research projects at the John F. Kennedy School of Government at Harvard University for nearly a decade. All of our projects are interdisciplinary in nature and involve faculty, master's degree students, and pre- and post-doctoral research fellows. At present, we have three faculty members, nine research fellows and visiting scholars, and three Kennedy School students directly involved in our research projects. In addition, many more faculty members and students engage in our work through participation in our bi-weekly research seminar. Elsewhere in this proposal are descriptions of some of our collaborative research projects in the United States, China, and India, so we will not repeat them here. For detailed descriptions of our research projects, please visit our website at: http://bcsia.ksg.harvard.edu/energy

Profs. Holdren and Lee will oversee the project and chair the workshops. Dr. Gallagher will manage the research. The post-doctoral fellow will be selected through ETIP's annual application process, though applicants in fields relevant tc the project will be preferentially recruited. The post-doctoral fellow will work closely with Dr. Gallagher in planning and conducting research.

We will hire several students to help us with the research. These students will be paid on an hourly basis, rather than as a percentage of salary. It is our plan to have at least two graduate students working on the project during the three summers and involve as many as three during the school year. We are fortunate to have in residence at the Kennedy School students who have enormous experience in related fields. These students will work closely with the Project PIs and staff on various aspects of the project.

A considerable portion of our total budget ($78,000 over three years) will be to commission research papers from experts on topics directly pertaining to the project. We anticipate requesting papers from both Harvard and non-Harvard experts. The cost per paper will vary according to specific research requirements and other variables.

II. Fringe Benefits

Following are Harvard University's fringe benefit rates, by personnel category, as a percentage of salary. We assume in the proposal that the project will begin on July 1, 2006 and end June 30, 2009. Grant years correspond, by coincidence, with Harvard's fiscal years.

Personnel Category	FY 2007 – FY 2009 (7/1/06 – 6/30/09)
Faculty	23.9
Administrative & professional staff	31.4
Research fellows	22.8
Student research assistants	7.7

III. Contractual Costs

We have budgeted for the following contractual costs:

a. As mentioned above, authors of commissioned papers will be paid on a consulting basis.
b. William Rosenberg will work closely with the project and be paid on a consulting/contractual basis. He will spend approximately one month in each grant year on the project, at a total cost of $36,000 over three years.
c. We will engage an event coordinator on a contractual basis to help us arrange and staff the workshops, handle the stakeholder process, and coordinate the production of the rapporteurs' reports. We have budgeted $46,400 over three years for both the event planning and coordination and the direct costs of the workshops themselves.

IV. Travel

We have allocated $13,400 in year 1, $18,500 in year 2, and $14,100 in year 3. These monies will be used for five purposes: 1) To interview and gather data from key stakeholders; 2) to visit and meet with EPA officials; 3) to make visits necessitated by our research needs; 4) for staff travel to workshops held in locations other than Cambridge, Mass.; and 5) to provide scholarship funds to a small number of workshop participants who might otherwise be unable to attend.

V. & VI. Equipment & Supplies

No funds are allocated to purchases of equipment or supplies.

VII. Other

No other expenses are included in the budget. The project will not pay stipends to interns, but will pay an hourly wage, including fringe benefits, to student research assistants. (See I. and II. above.)

VIII. Total Indirect Costs

The Harvard University federal overhead rate has been negotiated and set by the Department of Health and Human Services (DHHS) at 64%. Total indirect costs are $390,110. On the following three pages is Harvard University's "Colleges and Universities Rate Agreement" with DHHS.

COPY

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN #: 104210358081

DATE: January 21, 2004

INSTITUTION:
Harvard University
1350 Massachusetts Ave. Suite 370
Holyoke Center
Cambridge MA 02138-

FILING REF.: The preceding Agreement was dated February 24, 2003

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: FACILITIES AND ADMINISTRATIVE COST RATES*

RATE TYPES: FIXED FINAL PROV.(PROVISIONAL) PRED.(PREDETERMINED)

TYPE	EFFECTIVE PERIOD FROM	TO	RATE(%)	LOCATIONS	APPLICABLE TO
PRED.	07/01/02	06/30/04	63.0	On-Campus	Research
PRED.	07/01/04	06/30/06	64.0	On-Campus	Research
PRED.	07/01/02	06/30/06	29.0	On-Campus	Oth. Spon. Act.
PRED.	07/01/02	06/30/06	26.0	Off-Campus	All Programs
PROV.	07/01/06	UNTIL AMENDED	Use same rates and conditions as those cited for fiscal year ending June 30, 2006.		

*Base:
Total direct costs less items of equipment costing in excess of $5,000, subgrants and subcontracts, alterations and renovations, student aid and fees related to patient care. The rates do not apply to computer services acquired within the University.

U10601

INSTITUTION:
Harvard University

AGREEMENT DATE: January 21, 2004

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:
The fringe benefits are charged using the rate(s) listed in the Fringe Benefits Section of this Agreement. The fringe benefits included in the rate(s) are listed below.

TREATMENT OF PAID ABSENCES:
Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims for the costs of these paid absences are not made.

1. The rates in this agreement have been negotiated to reflect the administrative cap provisions to OMB Circular A-21 published by the Office of Management and Budget on May 8, 1996. No rate affecting the institution's fiscal periods beginning on or after October 1, 1991 contains total administrative cost components in excess of that 26 percent cap.

2. Equipment means an article of nonexpendable, tangible personal property having a useful life of more than one year, and an acquisition cost of $5,000 or more per unit.

3. Activities Performed Partly-On, Partly-Off Campus: The University uses the rate applicable to the location where the preponderance of the time and effort will be expended. Accordingly, each contract or grant is assigned only one indirect cost rate.

4. The Off-Campus rates apply to effort conducted on premises not owned by the University at locations sufficiently far removed from the campus to prohibit the normal use of University facilities and services.

5. Fringe Benefits: The University distributes fringe benefit costs to its departments and sponsored activities (including Federal programs) on the basis of annual rates applied to direct salaries and wages in lieu of individual direct charges. Over or under distribution of fringe benefit costs are carried forward in estimating future rates.

Included in the fringe benefit rates are: Pension, University Health Services, FICA, Health and Dental Plans, Worker's Compensation, Unemployment Compensation, Parking, Tuition Assistance (Employee Only), Life Insurance, and Disability Insurance.

The approved fringe benefit rates are as follows:

FIXED FRINGE BENEFIT RATES
7/1/04 - 6/30/05

CATEGORY:	Univ.Area
Faculty	25.4%
Exempt	32.0%
Unionized	40.4%
Temporary	9.4%
Post Docs	21.3%
Teach.Asst.	19.8%

Extra Compensation:
Pensionable: 15.0%
Non-Pensionable 8.0%

6. This Rate Agreement updates Fringe Benefit Rates only.

INSTITUTION:
Harvard University

AGREEMENT DATE: January 21, 2004

SECTION III: GENERAL

A. LIMITATIONS:
The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:
This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:
If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:
The rates in this Agreement were approved in accordance with the authority in Office of Management and Budget Circular A-21 Circular, and should be applied to grants, contracts and other agreements covered by this Circular, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:
If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:
Harvard University

(INSTITUTION)

(SIGNATURE)

ANN E. BERMAN

(NAME)

VICE PRESIDENT FOR FINANCE/CFO

(TITLE)

1/27/04

(DATE)

ON BEHALF OF THE FEDERAL GOVERNMENT:

DEPARTMENT OF HEALTH AND HUMAN SERVICES

(AGENCY)

(SIGNATURE)

Robert I. Aaronson

(NAME)

DIRECTOR, DIVISION OF COST ALLOCATION

(TITLE)

January 21, 2004

(DATE) 0601

HHS REPRESENTATIVE: Michael Leonard

Telephone: (212) 264-2069

Appendix: CV's of Key Personnel

JOHN P. HOLDREN, *Principal Investigator*

Education

Ph.D. (6/70), **Stanford University**, Department of Aeronautics & Astronautics and Institute for Plasma Research (Dissertation: "Collisionless Stability of an Inhomogeneous, Confined, Planar Plasma"; Oscar Buneman, advisor)

S.M. (6/66), **Massachusetts Institute of Technology**, Department of Aeronautics and Astronautics (Dissertation: "Landau Damping of Plasma Oscillations in a Uniform External Magnetic Field"; James McCune, advisor)

S.B. (6/65), **Massachusetts Institute of Technology**, Department of Aeronautics and Astronautics

Employment

9/96 – present **Harvard University**

John F. Kennedy School of Government:
Teresa and John Heinz Professor of Environmental Policy and Director, Program in Science, Technology, and Public Policy, Belfer Center for Science and International Affairs (7/96–).

Faculty of Arts and Sciences, Department of Earth and Planetary Sciences:
Professor of Environmental Science and Public Policy (7/96-).

Faculty of Arts and Sciences, Environmental Science and Public Policy Major:
Member of the Board of Tutors (9/96 –)

6/05 – present **Woods Hole Research Center**

President and Director

7/96 – 6/75 **University of California, Berkeley**

Professor of Energy and Resources Emeritus (7/96 –)

Class of 1935 Professor of Energy (8/91-6/96)

Professor of Energy and Resources (7/78-6/96)
Chair of Graduate Advisors, Energy and Resources Group (1988 – 96)
Vice Chair, Energy and Resources Group (1983-96, on leave 1987– 88)
Acting Chair, Energy and Resources Group (1982– 83, Fall 1990)
Associate Professor of Energy and Resources (7/75 – 6/78)
Assistant Professor of Energy and Resources (7/73 – 6/75)

1/72 – 9/73 **California Institute of Technology**

Senior Research Fellow, Division of Humanities & Social Sciences and Environmental Quality Laboratory

7/70 – 6/73 **Lawrence Livermore National Laboratory**

Physicist, Theory Group, Magnetic Fusion Energy Division (on leave 1/72 – 6/73)

7/69 – 6/70 **Stanford University**

Research Assistant, Institute for Plasma Research (7/69-6/70)

9/66 – 6/67 **Lockheed Missiles and Space Company, Sunnyvale, California**
Consultant in Re-Entry Physics (9/66-6/67)
Associate Engineer, Senior, Re-Entry Aerodynamics (Summer 1966)
Associate Engineer, Performance Analysis (Summer 1965)

Recent Concurrent and Visiting Appointments

Woods Hole Research Center: Woods Hole, Massachusetts: Visiting Scholar (1/92 – 7/92, 5/93-5/94); Distinguished Visiting Scientist (5/94-), Vice Chair of the Board of Trustees (5/94-)

Lawrence Livermore National Laboratory: Faculty Consultant, Magnetic Fusion Energy (subsequently Energy) Division (11/73-); Visiting Physicist, Theory Group, Magnetic Fusion Energy Division (Fall 1986); Faculty Consultant, Laser & Environmental Directorate (7/94 –).

Publications

Co-authored books and book-length reports (inverse chronological order)

Monitoring Nuclear Weapons and Nuclear-Explosive Materials: An Assessment of Methods and Capabilities, Committee on International Security and Arms Control (John P. Holdren, Committee Chair, William F. Burns, Study Co-Chair, Steven Fetter, Study Co-Chair, Spurgeon M. Keeny, Study Editor-in-Chief, and 12 others), National Academy of Sciences (National Academy Press, Washington, DC), April 2005, 264 pp.

Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges, National Commission on Energy Policy (John P. Holdren, Co-chair, William K. Reilly, Co-chair, John W. Rowe, Co-chair, Philip R. Sharp, Congressional Chair, Jason Grumet, Executive Director, and 12 others (NCEP, Washington DC), December 2004, 128 pp.

Controlling Nuclear Warheads and Materials: A Report Card and Action Plan, Matthew Bunn, Anthony Wier, and John P. Holdren, Project on Managing the Atom, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, for the Nuclear Threat Initiative (NTI, Washington, DC), March 2003, 231 pp.

Technical Issues Related to the Comprehensive Test Ban Treaty, Committee on Technical Issues Related to Ratification of the Comprehensive Test Ban Treaty (John P. Holdren, Chair, and 10 others), National Academy of Sciences (National Academy Press, Washington, DC), June 2002, 84 pp.

Securing Nuclear Weapons and Materials: Seven Steps for Immediate Action, Matthew Bunn, John P. Holdren, and Anthony Wier, Project on Managing the Atom, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, and the Nuclear Threat Initiative, May 2002, 78 pp.

Interim Storage of Spent Nuclear Fuel, Matthew Bunn, John P. Holdren, Allison Macfarlane, Susan E. Pickett, Atsuyuki Suzuki, Tatsujiro Suzuki, and Jennifer Weeks, Harvard University Project on Managing the Atom and University of Tokyo Project on Sociotechnics of Nuclear Energy, June 2001, 124 pp.
Co-authored books and book-length reports (continued)

Powerful Partnerships: The Federal Role in International Cooperation on Energy Innovation, Panel on International Cooperation in Energy Research, Development, Demonstration, and Deployment (John P. Holdren, Chair, Samuel F. Baldwin, Study Executive

Director, and 13 others), President's Committee of Advisors on Science and Technology (Executive Office of the President of the United States, Washington, DC), 1999, circa 300 pp.

Federal Energy Research and Development for the Challenges of the Twenty-First Century, Energy Research and Development Panel (John P. Holdren, Chair, Samuel F. Baldwin, Study Executive Director, and 20 others), President's Committee of Advisors on Science and Technology (Executive Office of the President of the United States, Washington, DC), 1997, circa 250 pp.

The Future of U.S. Nuclear Weapons Policy, Committee on International Security and Arms Control (John P. Holdren, Chair, William F. Burns, Study Chair, Jo L. Husbands, Staff Director, and 14 others), National Academy of Sciences (National Academy Press, Washington, DC), 1997, 100 pp.

Reactor-Related Options for the Disposition of Excess Weapons Plutonium, Panel on Reactor-Related Options (John P. Holdren, Chair, Matthew Bunn, Study Executive Director, and 6 others), Committee on International Security and Arms Control, National Academy of Sciences (National Academy Press, Washington, DC), 1995, 418 pp.

Management and Disposition of Excess Weapons Plutonium, Committee on International Security and Arms Control (John P. Holdren, Chair, Wolfgang K.H. Panofsky, Study Chair, Matthew Bunn, Study Executive Director, and 17 others), National Academy of Sciences (National Academy Press, Washington, DC), 1994, 275 pp.

Report of the Senior Advisory Committee to the Department of Energy on Environmental, Safety, and Economic Aspects of Magnetic Fusion Energy, John P. Holdren, Chair, and 9 others, Lawrence Livermore National Laboratory UCRL-53766 (National Technical Information Service, Springfield, VA), 1989, 345 pp.

Energy in Transition 1985-2010, Committee on Nuclear and Alternative Energy Systems (Harvey Brooks and Edward Ginzton, Co-Chairs, and 14 others), National Research Council (W.H. Freeman, San Francisco), 1980, 677 pp.

Ecoscience: Population, Resources, Environment, Paul R. Ehrlich, Anne H. Ehrlich, and John P. Holdren (W.H. Freeman, San Francisco), 1977, 1051 pp.

Fusion and Fast Breeder Reactors, W. Haefele, J. Holdren, G. Kessler, and G. Kulcinski, with contributions by A. Belostotsky, R. Grigoriants, D. Kurbatov, G. Shatalov, M. Styrikovich, and N. Vasiliev (International Institute for Applied Systems Analysis, Vienna, 1977), 506 pp.

Human Ecology: Problems and Solutions, Paul R. Ehrlich, Anne H. Ehrlich, and John P. Holdren (W.H. Freeman, San Francisco), 1973, 304 pp. German edition: **Humanokologie** (Springer Verlag, Berlin/Heidelberg), 1975, 234 pp.

Energy: A Crisis in Power, John Holdren and Phil Herrera [separately authored halves of the book] (Sierra Club Books, New York), 1971, 252 pp. Japanese edition, Blue Backs, Tokyo, 1977.

Books co-edited

Conversion of Military R&D Judith Reppy, Vsevolod Avduyevsky, John Holdren, and Joseph Rotblat, eds.(MacMillan, Basingstoke, UK) 1998, 296 pp; **Building Global Security Through Cooperation**, J. Rotblat and J. P. Holdren, eds. (Springer-Verlag, Berlin), 1990, 301 pp; **The Cassandra Conference: Resources and the Human Predicament**, P. R. Ehrlich and J. P. Holdren, eds. (Texas A&M University Press, College Station), 1988, 330 pp; **Strategic Defences and the Future of the Arms Race**, John P. Holdren and Joseph Rotblat, eds. (MacMillan, London), 1987, 286 pp; **Earth and the Human Future**, Kirk R. Smith, Fereidun Fesharaki, &

John P. Holdren, eds. (Westview, Boulder, CO), 1986, 258 pp; **Population: Perspective 1973**, Harrison Brown, John Holdren, Alan Sweezy, and Barbara West, eds. (Freeman-Cooper, San Francisco), 1974, 284 pp; **Man and the Ecosphere**, Paul R. Ehrlich, John P. Holdren, and Richard W. Holm, eds. (W.H. Freeman, San Francisco), 1971, 307 pp; **Global Ecology**, John P. Holdren & Paul R. Ehrlich, eds. (Harcourt Brace Jovanovich, New York), 1971, 292 pp;

Other publications (full listing available upon request)

About 140 peer-reviewed professional papers, book chapters, and technical reports on plasma physics, energy technology and policy, population-resource-environment interactions, and international security and arms control (in, e.g., **Plasma Physics, Fusion Technology, Energy, Annual Review of Energy and the Environment, Science, Scientific American, Bulletin of Atomic Scientists, Environment, Energy Policy, Issues in Science and Technology, Daedalus**). About 90 published book reviews, comments, and popular articles on these subjects (in, e.g., **Saturday Review, The London Times, The New York Times, The Christian Science Monitor, The Chicago Tribune, The International Herald Tribune**). About 110 additional published contributions in conference proceedings, hearings, and so on.

Honors (inverse chronological order)

-President-Elect, American Association for the Advancement of Science, 2005
-Jerome Wiesner Lecture, University of Michigan, 2002
-Honorary Sc.D., Clark University, 2002
-Joseph Rotblat Lecturer, Annual Student Pugwash Conference, 2002
-National Associate of the U.S. National Academies (award "for exceptional service"), 2001
-John Heinz Prize in Public Policy, 2001
-Member of the National Academy of Engineering (elected 2000)
-Tyler Prize for Environmental Achievement, 2000
-Sidney Drell Lecturer, Stanford University, 2000
-Kaul Foundation Award for Excellence in Science and Environmental Policy, 1999
-Fusion Leadership Award for 1998, Fusion Power Associates, Washington DC,
-Honorary D.Eng., Colorado School of Mines, 1997
-Council on Foreign Relations (elected 1996)
-1995 Nobel Peace Prize acceptance lecture for the Pugwash Conferences on Science & World Affairs
-Forum Award of the American Physical Society, 1995
-Volvo Environment Prize, 1993
-Member of the National Academy of Sciences (elected 1991)
-Fellow of the American Physical Society (elected 1988)
-Fellow of the American Association for the Advancement of Science (elected 1987)
-Fellow of the California Academy of Sciences (elected 1985)
-Fellow of the American Academy of Arts and Sciences (elected 1983)
-Kistiakowsky Visiting Scholar for the American Academy of Arts and Sciences, 1983-84
-MacArthur Foundation Prize Fellowship, 1981-86
-Federation of American Scientists Public Service Award for 1979
-Gustavsen Memorial Lecturer, University of Chicago, 1978
-Honorary Sc.D., University of Puget Sound, 1975
-Distinguished Teaching Award of the University of California, Berkeley, 1975

Committees and Boards

National Commission on Energy Policy (Co-Chair, 2002 –)

President's Committee of Advisors on Science and Technology, Executive Office of the President of the United States (1994 – 2001)

Chair, Panel on Nuclear Materials Protection, Control, and Accounting, 1994 – 95
Chair, Panel on Research on Magnetic Fusion Energy, 1995;
US Chair, US-Russian Scientific Commission on the Disposition of Surplus Plutonium, 1996– ;
Chair, Panel on U.S. Federal Energy R&D for the Challenges of the 21st Century, 1997;
Chair, Panel on International Cooperation in Energy Research, Development, Demonstration, and Deployment, 1998 – 99)

National Academy of Sciences / National Academy of Engineering

Roundtable on Scientific Communication and National Security, The National Academies (Member,2003–)
Joint Working Group of the US National Academies and the Russian Academy of Sciences on US-Russian Cooperation on Nuclear Non-Proliferation (US Chair, 2002–)
Committee on Technical Issues Related to Ratification of the Comprehensive Test-Ban Treaty (Chair, 2000–2002)
Committee on US-India Cooperation on Energy (Chair 1999–)
Committee on Balancing Scientific Openness and National Security Controls at the National Weapons Laboratories (member 1998–1999)
Committee on US-China Cooperation on Energy (ex officio member, 1998–2000)
Advisory Board, ISSUES IN SCIENCE AND TECHNOLOGY (1996–)
Committee on International Security and Arms Control (1992–; Chair 1993–;
Chair of the Panel on Reactor-Related Options for Disposition of Weapon Plutonium, 1992–95; US Co-Chair of the Working Group of US-China Cooperation on Energy and Security,1995-97; Chair of the Panel to Review the Spent-Fuel Standard for Disposition of Excess Weapons Plutonium, 1999–.)
Panel on Human Impacts on Ecosystems (Chair), Board on Biology and Commission on Behaviorial and Social Sciences and Education (1991)
Committee on Nuclear & Alternative Energy Systems (1975-9)-Committee to Survey the Literature of Nuclear Risks (1975 –79)
International Environmental Programs Committee (1970 – 75)
Panel on Environment and Growth, Committee for the Study of Research Applied to National Needs (1973).

American Association for the Advancement of Science

Advisory Committee on International Science, 2004–
Board of Directors of the AAAS, 2005–

American Academy of Arts and Sciences

Committee on International Security Studies (1982-99, Vice Chair 1983 – 99).
U.S. Pugwash Committee (Chair 1983-91, Co-Chair 1992 – 95)

U.S. Department of Energy Committees

Fusion Energy Advisory Committee (1991– 94)
U.S. National Review Committee for the International Thermonuclear Engineering Reactor Conceptual Design Activity (1991)
Senior Committee on Environmental, Safety, and Economic Aspects of Magnetic Fusion Energy
(Chair 1985 – 89)
Energy Research Advisory Board (1978 – 79)

Pugwash Conferences on Science and World Affairs
Member of the International Council (1982–97)
Member of the Executive Committee of the Council (1982-97, Chair 1987–97)

MacArthur Foundation
Member of the Board of Directors (1991–2005; Chair of the Board Committee for the Program on Peace and International Cooperation, 1994-96; Budget Committee, 2000–\2005; Chair of the Committee on Institutional Policy, 2002-2005)
Advisory Panel to the International Security Program (1984–68)

Federation of American Scientists (Council Member, 1974-78, 1979-86; Treasurer, 1979-80; Vice Chairman, 1980-84; Chairman, 1984-86)

Editorial Boards: Issues in Science and Technology (2000--), International Journal of Global Energy Issues (1989--); Science and Global Security (1987--); Environmental Conservation (1984-2000); Bulletin of the Atomic Scientists (1984-86, Advisory Council 1979-81); Soft Energy Notes (1979-82); Resources and Energy (1978-90); Annual Review of Energy (1975-82).

Other: Executive Committee, Fusion Division, American Nuclear Society (1987-1991); Advisory Council, Aldo Leopold Leadership Program (1995-2001); Jury for the 2000 Blasker Energy Prize; US-China Advisory Council for Sustainable Development (2000--), International Climate Change Task Force (2004-5), United Nations Special Experts Group on Climate Change (2004--)

Harvard Teaching (FAS = Faculty of Arts and Sciences, KSG = Kennedy School of Government)

Junior Seminar in Environmental Science and Public Policy (FAS 1997,99,01,03); Energy Systems (KSG 1996,97,98,99,00,01,03,05); Interdisciplinary Science and Technology Assessments for Policy (KSG 1997,98,99,00,01,02,04,05); Introduction to Environmental and Resource Science for Policy (KSG 00,01,03,04,05); Introduction to Science and Technology Policy (KSG 97,01,03,04,05)

WILLIAM G. ROSENBERG, *Senior Research Fellow*

Education

JD (1965) **Columbia University**, School of Law
MBA (1965) **Columbia University**, School of Business
BA (1961) **Syracuse University**

Work Experience

Academia

2005-Present School of Engineering, Carnegie Mellon University
Professor of the Practice, Department of Engineering and Public Policy

2003- Present John F. Kennedy School of Government, Harvard University.
Senior Fellow, Center for Business and Government, with joint appointment in Belfer Center for Science and International Affairs.

1991-2001 Maxwell School of Citizenship and Public Affairs, Syracuse University
Advisory Board (1991-2001)
Visiting Lecturer (Fall 2001)

Public Sector

2002-2003 Chairman and President, Michigan Broadband Development Authority. Established tax exempt and taxable revenue bond financing for statewide broadband access. Appointed by Governor John Engler. (2002-2003)

1989-1993 Assistant Administrator, Air and Radiation, U.S. Environmental Protection Agency. Developed and negotiated Clean Air Act of 1990, including implementation regulations for Acid Rain Allowance Trading, CFC phase-out and reformulated gasoline, with emphasis on stakeholder regulatory negotiations. Appointed by President George H.W. Bush.

1975-1977 Assistant Administrator, Energy Resource Development, Federal Energy Administration. Appointed by President Gerald R. Ford. (1975-1977)

1973-1975 Member, President's Project Independence Advisory Committee. Appointed by President Richard M. Nixon. Chairman, Michigan Public Service Commission during Arab oil embargo. Appointed by Governor William G.. Milliken.

1969-1973.1 Executive Director, Michigan State Housing Development Authority. Organized tax-exempt state revenue bond financing and loan program for low and moderate-income housing. Appointed by Governor William G. Milliken.

Private Sector

1995-Present Joint Venture with Engelhard Corporation. Joint-patent holder of PremAir Ozone Catalyst qualified under California Air Resources Board and EPA regulations. Auto manufacturers began installation in model year 2001. (1995-present).

1993-Present Founder and President, E^3 Ventures, Inc.. Provided strategic environmental and energy advice to major companies (utility, oil, pharmaceutical, environmental technology), national environmental groups, and state and local agencies.

1977-Present Principal, Rosenberg, Freeman & Associates. Developed, financed and constructed 3,000 low and moderate income housing units and conventional apartments, and raised debt and equity for real estate finance.

1987-1989	Investor, cellular radio (Lansing, Flint, Grand Rapids) sold to Pacific Bell.
1982-1989	Investor, Avalon Ventures, seed-capital venture capital company that organized more than 20 high-tech electronics and biotech start-up companies.
1982-1990	Attorney, Honigman, Miller, Schwartz and Cohn, Detroit, Michigan, specialized in corporate finance, taxation and real estate, (1965-69).

Publications

"Deploying IGCC Technology in this Decade with 3Party Covenant Financing", July 2004: www.ksg.harvard.edu/bcsia/enrp

"National Gasification Strategy", January2005:

http://bcsia.ksg.harvard.edu/publication.cfm?program=STPP&ctype=paper&item_id=473
"On My Mind-The Other Gas Crunch" Forbes, November 2004

KELLY SIMS GALLAGHER, *Director, Energy Technology Innovation Project*

Education

Ph.D. (2003) (International Relations), M.A. (2000) (Law and Diplomacy) **Fletcher School of Law and Diplomacy, Tufts University**

- *Fields:* International Environment & Resource Policy, Negotiation & Conflict Resolution, and East Asia

A.B., Environmental Science and Diplomacy & World Affairs, **Occidental College**, *cum laude* and with honors

Professional Experience

2003 –	Director, Energy Technology Innovation Project, Belfer Center for Science & International Affairs, Kennedy School of Government, Harvard University: Director of research group on national and international energy policy, with particular focus on the United States, China, and India. Supervise group of pre- and post-doctoral fellows and master degree student research assistants, manage $1 million annual budget of grant-sponsored research, and serve as adjunct lecturer.
2001–2003	Research Fellow, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University: Member of the Energy Technology Innovation Project as pre-doctoral and post-doctoral fellow -Co-founder and coordinator of research partnership with China Ministry of Science and Technology Policy on clean vehicle and clean coal policy issues
2000	Research Assistant, Conflict Management Group (Cambridge, MA)
1998–1999	Project Coordinator, Tufts Climate Initiative, Tufts Institute of the Environment (Medford, MA)
1995–1998	Science Policy Director, Ozone Action (Washington, DC)
1997–1998	Consultant, CNN (Japan and Argentina)
1995	Intern, The White House, Office of the Vice President (Washington, DC)
1994	Director of EnfoBase, Fluor Daniel Environmental Services (Irvine, CA)
1993	Intern, U.S. Mission to the United Nations (New York, NY)

Teaching Experience

2005	Adjunct Assistant Professor, Fletcher School of Law & Diplomacy, Tufts University (Medford, MA) Taught *Energy Policy in an International Context*

2004 – Adjunct Lecturer, John F. Kennedy School of Government, Harvard University (Cambridge, MA)
Co-taught doctoral seminar, *Science, Technology and Innovation for Sustainable Prosperity*, with John P. Holdren, Calestous Juma, and William Clark
Served as faculty member in following Executive Programs:
Executive Program on Energy Policy in Mexico, 2005
Executive Program on Science, Technology and Innovation, 2004 and 2005
Leader of bi-weekly seminar of the Energy Technology Innovation Project

2000–2001 Teaching Assistant, Fletcher School of Law and Diplomacy and Tufts College:
Energy & Environmental Policy (Prof. William R. Moomaw, Fletcher)
U.S. Foreign Economic Policy (Prof. Kerry Chase, Tufts)

2000 Teaching Assistant, Kennedy School of Government, Harvard University:
Designing and Managing Energy Systems
(Prof. John P. Holdren and Prof. Henry Lee)

2000 Teaching Fellow, Climate Change & Development, Harvard Institute for International Development

Publications

Books

China Shifts Gears: Automakers, Oil, Pollution, and Development, MIT Press, accepted for publication, forthcoming 2006.

"A-Z of the Environment," with William R. Moomaw, **The Environment Encyclopedia and Directory 2001, London: Europa Publications, 2001.**

Doctoral Thesis

Foreign Direct Investment as a Vehicle for Deploying Cleaner Technologies: Technology Transfer and the Big Three Automakers in China. Ph.D. Dissertation, Medford, MA: Fletcher School of Law & Diplomacy, Tufts University, June 2003.

Peer-Reviewed Journal Articles and Book Chapters

Gallagher, Kelly Sims, Holdren, John P., and Ambuj Sagar, "Energy-Technology Innovation," *Annual Review of Environment and Resources*, forthcoming 2006.

Gallagher, Kelly Sims, "Limits to Leapfrogging in Energy Technologies: Evidence from the Chinese Automobile Industry," *Energy Policy*, Vol. 34, No. 4, pp. 383-394, 2005.

Gallagher, Kelly Sims, "Foreign Technology in China's Automobile Industry: Implications for Energy, Economic Development, and Environment." *China Environment Series*, Washington, D.C.: Woodrow Wilson Center for International Scholars, 2003.

Gallagher, Kelly Sims, "The Viability and Design of International Greenhouse Gas Emissions Trading," in Susskind, Lawrence et al. (eds), *International Environmental Negotiation: An Integrative Approach*. Cambridge: PON Books, Harvard Law School, 1999.

Research Papers and Reports

Gallagher, Kelly Sims and Hongyan He Oliver. "Providing Low-Sulfur Fuels for Transportation Use: Policy Options and Financing Strategies in the Chinese Context." Paper presented at International Conference on Low-Sulfur Fuels, sponsored by the U.S. Environmental Protection Administration and China's State Environmental Protection Administration, Beijing, July 2005.

Gallagher, Kelly Sims, Ambuj Sagar, Diane Segal, Paul de Sa, and John P. Holdren. "U.S. Government Investments in Energy Innovation Database." Belfer Center for Science and International Affairs, 2005.

Sagar, Ambuj and Kelly Sims Gallagher, "Energy Technology Demonstration and Deployment." In Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges. Washington, D.C.: National Commission on Energy Policy, December 2004.

Gallagher, Kelly Sims and John P. Holdren, "U.S. Government Policies Relating to International Cooperation on Energy." In Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges. Washington, D.C.: National Commission on Energy Policy, December 2004.

Gallagher, Kelly Sims, Robert Frosch, and John P. Holdren. "Management of Energy - Technology Innovation Activities at the Department of Energy." In Ending the Energy Stalemate: A Bipartisan Strategy to Meet America's Energy Challenges. Washington, D.C.: National Commission on Energy Policy, December 2004.

Gallagher, Kelly Sims and Jimin Zhao, "Lessons from U.S. Clean Vehicle Policy," *Belfer Center for Science & International Affairs Working Paper Series*, Energy Technology Innovation Project, Cambridge, MA: Harvard University, 2004.

Zhao, Jimin and Kelly S Gallagher, "Clean Vehicle Development in China." *The Sinosphere Journal*, Vol. 6, No. 2, March 2003.

Gallagher, Kelly Sims, "US-China Energy Cooperation: A Review of Joint Activities Related to Chinese Energy Development Since 1980," *Belfer Center for Science & International Affairs Working Paper Series*. Paper 2001-21, Energy Technology Innovation Project, Cambridge, MA: Harvard University, Nov. 2001.

Gallagher, Kelly Sims, "Charge to the Bush Administration," *China Environment Series*. Woodrow Wilson International Center for Scholars, Issue 4, 2001, 57-59.

"What Road Ahead? Scenarios for the Future of United States-China Relations, 2001-2010," Workshop Report Sponsored by Nautilus Institute, April 2001 (co-author with all participants).

Reviews

Gallagher, Kelly Sims, "Book Review" of The River Runs Black by Elizabeth Economy, *Journal of Asian Studies*, forthcoming 2006.

Gallagher, Kelly Sims, "Book Review" of Greening Chinese Business by Steger, Zhaoben, and Wei, *Ecological Economics*, 2004.

Opinion

"Untie Utilities' Hands on Coal," with Jennie C. Stephens, *The Albuquerque Journal*, 10 March 2005.

Letter to the Editor on "Cars in China," *Foreign Policy*, Carnegie Endowment, Washington, D.C, January 2003.

"Bush's Air Plan," *Foreign Policy In Focus*, A Global Affairs Commentary, February 19. 2002.

Chronicle of Higher Education, "The Uncertainties of Global Warming" (Letter with William Moomaw)

The Boston Globe "Cleaning Up the US Role on Climate," October 28, 1998 (Op-Ed with William Moomaw)

Los Angeles Times "Options Quickly Running Out in the Former Soviet Union," July 22, 1994 (Op-Ed with Larry T. Caldwell)

Pasadena Star Tribune, "Russian Dilemma," Spring 1994. (Op-Ed with Larry T. Caldwell)

Invited Talks

"Energy & Autos in China," seminar sponsored by the Regional Economics and Social Development Department and the Center for Industrial Competitiveness, University of Massachusetts Lowell, 19 November 2005.

"Chinese Energy Demand," conference sponsored by the Center for Energy & Environmental Policy Research, Massachusetts Institute of Technology, 17 November 2005.

"China's Auto Industry: Reconciling Economic Development, Energy Markets, Environmental Quality, and Oil Security," U.S. State Department, Washington, DC, 29 September 2005.

"Foreign & Domestic Automakers in China: Reconciling Economic Development, Environmental Quality, and Oil Security," U.S. China Chamber of Commerce, Detroit, MI, 16 June 2005.

"Zoom Zoom Zoom: China's Automobile Revolution," Harvard China Review Conference on Copious Consumption: China's Growing Appetite, 30 April, 2005.

"Energy and Environmental Policy," Tsinghua University School of Public Policy and Management, Beijing, China: 19 November 2004.

"The U.S. Presidential Elections and the Future of the Environment," Panelist, Brown University, 26 October, 2004.

"Innovation and Learning in the Chinese Automobile Industry Through Technology Transfer," paper given at Globalics
Conference, Beijing, China: 18 October 2004.

"Fuel Efficiency Policy Options," International Energy Agency and UN Environmental Program Conference, Shanghai, China: 13 October 2004.

"Drivers of Technological Change in the Chinese Automobile Industry Through Technology Transfer," Lawrence Berkeley National Laboratory, Berkeley, CA: 13 July 2004.

"U.S.-China Energy Cooperation," Workshop on Clean Coal Technologies organized by the China Ministry of Science & Technology and China Coal Research Institute, Hangzhou, China 15 May 2004.

"Car Wreck? Reconciling Economic Development, Environmental Quality, and Oil Security in China," World Resources Institute Conference on Urban Transport in China, Washington, DC, 13 January 2004.

"Technology Transfer in the Automobile Industry," U.S.-China Chamber of Commerce Annual Meeting, Chicago, 30 October 2003.

"Automobiles and the Environment," Professional Association on China's Environment Conference (panel chair and speaker), Beijing, 23 October 2003.

"The Role of Foreign Technologies in Greening Chinese Urban Transportation Development," Conference at Jiaotong University on Multi-modal Transportation for Chinese Cities, Shanghai, 20 October 2003.

"Foreign Direct Investment as a vehicle for Deploying Cleaner Technologies: The Big Three in China," conference presentation at the U.S. Society for Ecological Economics Annual Meeting, Saratoga Springs, May 23, 2003.

"Foreign Direct Investment as a Vehicle for Deploying Cleaner Technologies: The Big Three Automakers in China," Energy Technology Innovation Project Seminar, Belfer Center for Science & International Affairs, Harvard University, February 9, 2003.

"Globalized China?" Interdisciplinary Lecture Series, Skidmore College, November 13, 2002.

"Technology Transfer from the U.S. to China: Barriers and Incentives," Joint Ministry of Science & Technology – Harvard University Workshop, Beijing, China, October 25, 2002.

"U.S. Energy Policy," Department of Strategy Research, National Research Center for Science & Technology Development, Ministry of Science & Technology, Beijing, China, June 25, 2002.

"U.S. Fuel Efficiency Policy: Lessons for China," China Automotive Research and Technology Research Center Workshop, Tianjin, China, June 7, 2002.

"U.S. Clean Vehicle Policy: Lessons for China," with Jimin Zhao, China Ministry of Science & Technology (MOST) and Belfer Center for Science & International Affairs Joint Workshop at Harvard University, April 15, 2002.

"Deployment of Cleaner Motor Vehicles in China: China's Domestic Capacity for Energy Innovation and the Role of Technology Transfer." Mario & Luisa Molina Mexico City Project, Massachusetts Institute of Technology, April 5, 2002.

Transatlantic Environmental Dialogue, Climate Policy Working Group, Brussels, 1999

"What Moves People to Act on Global Warming," Interfaith Center on Corporate Responsibility Board Meeting, New York, NY, 1998.

Delivered speech on behalf of 243 environmental organizations to the UN Framework Convention on Climate Change international negotiations in Bonn, Germany, March 1997.

Reviewer

National Science Foundation
Negotiation Journal
Ecological Economics
Energy Policy

Media Interviews *(selected)*

The Day After Tomorrow Deluxe Edition DVD, featured on Science & Policy Documentary
NOVA, "China Revs Up" Earth Day Special, April 2004
National Public Radio Marketplace, September 2003
CNN "Insight" and International, 1998
CNN Asia This Day, 1997; CNN International, 1997
CNN International Global View, Interview with Ralph Begleiter, 1997
National Public Radio, Interview on Talk of the Nation, June 1997
Quoted in a variety of news outlets including *NPR, CNN, Wall Street Journal, USA Today, Reuters*

Honors/Awards

2004 Holly Taylor Sargent Prize for Women's Advancement in Recognition of Outstanding Contributions to the Advancement of Women, John F. Kennedy School of Government, Harvard University.

2001-2003 Pre-and Post-Doctoral Research Fellowship at John F. Kennedy School of Government, Harvard University

2001 P.E.O Scholarship
1999 Robert & Patricia Switzer Foundation Fellowship
1994 Harry S. Truman Scholar
1993 Stuart Moldaw Family Foundation Scholarship
1993 Cynthia Cox Memorial Award for Outstanding Female Sophomore
1993 Mayor's Certificate of Appreciation and Citizenship, Mayor Tom Bradley, Los Angeles
1992-95 Carnation Merit Scholarship
1992 Certificate of Appreciation, City of Los Angeles "for outstanding citizenship"

Languages

Proficient in Spanish and conversational Mandarin Chinese.

(202)-343-9231

83321701

Electronic Grant File - Award

Title: President and Fellows of Harvard College

Document Status:

Status as of: 12/16/2011 **Closed Award**

Documents are in: Historical

Workplans & Applications	Awards/IA/Fellowship
No Application Available for 83321701-4	<= Award Document (Final)

Grant Information

Program Code:	XA **Grant Number:** 83321701-4 **IFMS ODN:** XA83321701		
Applicant Name:	HARVARD - President and Fellows of Harvard College		
DUNS:	001963263		
Applicant Type:	Private University	**Record Type:**	F
EPA Region:	EPA HQ	**AAShip:**	OAR - Office of Air and Radiation
State:	MA	**Division/Office:**	
Cong District:	08	**Lab/Office:**	
CFDA:	66.034	**Media:**	Air
Project Officer:	Elizabeth Etchells	**Grant Specialist:**	Jessica Durand
Amount Requested:	$999,658	**Award Amount:**	$0
Portion Funded:		**Cum Award:**	$995,823
Project Start:	10/01/2006	**Project End:**	02/28/2011
Budget Start:	10/01/2006	**Budget End:**	02/28/2011

Project Description

This project will expore, identify, and recommend new policy solutions to the dilemma of deploying cleaner vehicle technologies through research, analysis, dialogue with stakeholders, conferences and workshops, and the publishing of papers and reports.

Key Dates

Pre-Award		Post-Award	
Date Received:	07/05/2006	**Award Date:**	09/08/2010
Date Sent to PO:		**Acceptance Date:**	10/01/2010
Funding Package:	08/30/2010	**Closeout Date:**	12/15/2011

Action Code Table

Entry	Date	Action
P	08/30/2010	3 - Funding Recommendation w/Change Request Received By GMO
E	09/08/2010	F - Award
E	12/15/2011	FC - Completion of All Work Project Closed Out

8/20/13 Email sent to PO Elizabeth Etchells requesting original grant application and workplan.